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RELATIONSHIP BETWEEN PSYCHO-SOCIAL VARIABLES AND ACHIEVEMENT IN SCIENCE AMONG HIGH SCHOOL STUDENTS

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RESEARCH ARTICLE

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Abstract

In this study, it was aimed to Achievement in Science of high school students in relation to Psycho-Social variables using Discriminant Function Analysis. The investigator selected Normative Survey Method Research for carrying out the present study. The sample is selected through Stratified Sampling Technique used for the study. A total of 3 Government, 4 Government Aided, 3 Corporation and 5 Private Schools are selected. All the IX and X Standard Students from the mentioned schools are taken as the sample for the present study. Hence the sample comprises of 488 students of Chennai, Thiruvallur, Kancheepuram and Thanjavur Districts of Tamil Nadu. All the relevant information was collected through Personal Data Sheet and Questionnaires Constructed and Validated by the investigator. Data was coded into SPSS 22.0 (version) and Microsoft Excel 2007. The purpose of the present study is to Analyze if factors such as Gender, Fathers' Educational Qualification, Mothers' Educational Qualification, Income of the Family, Family Size, Locality of the School, Type of the School, Management of the School, Overall Science Interest, Overall Attitude towards Science Practical, Overall Availability of Physical Facilities, Overall Achievement in Science affect Achievement in Science among High School Students. Study shows that overall Achievement in Science is best Predictor followed by Availability of Physical Facilities, Overall Attitude towards Science Practical, Overall Science Interest, Fathers' Educational Qualification, Mothers' Educational Qualification, Gender, Management of the School, Locality of the School and Family Size. Two variables were found to have Negative Coefficient such as Income of the Family and Type of the School which shows a Negative Contribution towards the Discriminant Function.

Keywords: *Achievement in Science, Science Interest, Discriminant Function Analysis, Canonical Correlation, Psycho-Social Variables, High School Students of Tamil Nadu.*

1.0 Introduction

Science as an enterprise has individual, social and institutional dimensions. Scientific activity is one of the main features of the contemporary world that distinguishes our times from earlier centuries. Scientific work involves many individuals doing many different kinds of work and goes on to some degree either in day-to-day life or as a deliberate effort. People throughout the world participate in science and its applications. Human being's future is stubbornly linked to scientific advances and the development of productive activity. Obviously, therefore, science must find a respectable place in the school curriculum. The entire world over, this feeling is being generated.

In India, through the efforts of National Council for Educational Research and Training (NCERT), science has been made a compulsory subject throughout the school stage.

2.0 Objectives of the Study

- To analyze if below mentioned factors affect Achievement in Science among High School Students
  - Gender
  - Fathers' Educational Qualification
  - Mothers' Educational qualification
  - Income of the Family
  - Family Size
  - Locality of the School
  - Type of the School

  - Management of the School
  - Overall Science Interest
  - Overall Attitude towards Science Practical
  - Overall Availability of Physical Facilities
  - Overall Achievement in Science
- To examine whether there is an equal variance between or among the group based on
  - Gender
  - Fathers' Educational Qualification
  - Mothers' Educational Qualification
  - Income of the Family
  - Family Size
  - Locality of the School
  - Type of the School
  - Management of the School
  - Overall Science Interest
  - Overall Attitude towards Science Practical
  - Overall Availability of Physical Facilities
  - Overall Achievement in Science
- To measure the strength of relationship between predictive variables and outcome groups
- To establish the relationship between students' demographic and research factors and Achievement in Science among High School Students.

3.0 Review of Related Literature

Ramesh Krishna Boruah., Soni., (2016) a comparative study of Academic Achievement in Science of Secondary School Students in Lakhimpur and Karbi Anglong districts of Assam. The study is conducted on a sample of 800 students comprising of 420 boys and 380 girls selected randomly from both Government and Private Schools of the districts. Academic Achievement Record was used as the tool of the present study. For this purpose, the investigator visited the selected schools and collected the performance records of the selected students i.e. marks obtained in science by the students in the H.S.L.C. Final Examination; 2014-15. For collection of data Descriptive Survey Method is used. The study clearly revealed that in the whole sample the secondary school students studying in government and private schools as well as belonging to urban and rural areas show significant difference in respect of their science subject. But no significant difference was found in achievement in science subject of male and female students of Lakhimpur and Karbi Anglong Districts.

Abrahams Ian., Reiss., et al., (2014) to evaluate the impact of the getting practical Improving practical work in science CPD programme on teachers' ideas and practice in science practical work in primary and secondary schools in England. Sample: 10 teachers of primary science and 20 secondary science teachers', interview and observational method was used. The findings suggest that if change rather than only an enhanced awareness of the issues practice then there is a need for ongoing support over an extended period of time.

Soundararajan (2013) focused the major purpose of this research was to study the level of science interest of higher secondary school students. The data were collected by means of Science Interest of Higher Secondary School Students Constructed by N.O Nellaiyappan Scale have been administered to a Random Sample of 300 Higher Secondary School Students in Dindigal District. The Normative Survey Method has been used. The collected data were subjected to 't' test and 'F' test for large independent groups. The findings indicate there is a significant difference in the level of science interest between the urban and rural students and the Type of Management. But there is no significant difference in the level of science interest between boys and girls, Parents' Occupation and Parents' Education.

4.0 Research Methodology Used for the Study

In this study a linear Discriminant Function Analysis, to discriminate High School students according to their Achievement in Science, was formed. Achievement in Science of High School students was taken as a dependent variable whereas, student's demographic Gender, Fathers' Educational Qualification, Mothers' Educational Qualification, Income of the Family, Family Size, Locality of the School, Type of the School, Management of the School and research Overall Science Interest, Overall Attitude towards Science Practical, Overall Availability of Physical Facilities, Overall Achievement in Science factors were taken as Independent Variables.

The investigator selected Normative Survey Method research for carrying out the present study. The sample is selected through Stratified Sampling Technique Used for the study. A total of 3 Government, 4 Government Aided, 3 Corporation and 5 Private Schools are Selected. All the IX and X standard students from the mentioned schools are taken as the sample for the present study. Hence the sample comprises of 488 students of Chennai, Thiruvallur, Kancheepuram and Thanjavur Districts of Tamil Nadu. All the relevant information was collected through personal data sheet and questionnaires constructed and validated by the investigator. Data was coded into SPSS 22.0 (version) and Microsoft Excel 2007. Discriminant Function Analysis was carried

out for testing the hypothesis that the Achievement in Science among High School Students is independent of the factors the mentioned above. The outcome of the analysis is discussed in the following section of this study.

5.0 Data Analysis and Interpretations of the Study: Data analysis and interpretation of the outcome have been presented in the following lines:

6.0 Discriminant Function Analysis

The linear Regression Analysis is primarily concerned with predicting the value of the dependent variable from a given set of independent variables. But Discriminant function analysis is concerned with developing a linear equation to distinguish two or more a priori groups from each other, that is, to develop a mathematically precise Discriminant function based upon a set of variables or attributes.

In Discriminant Function Analysis, we are specifically interested in finding out the linear composite of variables that best discriminates between groups. Here the criterion of the best is defined as the specific weighing of variables, so that the ratio of the variables between the groups sum of squares of linear functions has a larger value than that of any other possible linear function of the same variables (i.e., ratio is maximized). The ratio itself is called the Discriminant criterion and this optimum linear combination of the variables is called Discriminant Function. The variables and codes used in Discriminant Function Analysis is given in below table.

Table – 1
Variables and Codes Used in Discriminant Function Analysis

S. No	Variable Code	Variables
1	X1	Gender
2	X2	Fathers' Educational Qualification
3	X3	Mothers' Educational qualification
4	X4	Income of the Family
5	X5	Family Size
6	X6	Locality of the School
7	X7	Type of the School
8	X8	Management of the School
9	X9	Overall Science Interest
10	X10	Overall Attitude towards Science Practical
11	X11	Overall Availability of Physical Facilities
12	Y	Overall Achievement in Science

For the present purpose, the entire sample of 488 high school students have been classified into low, average and high on their Achievement in Science. The cut-off criterion of m ±1σ (Mean (M) = 63.84 and standard deviation (σ) = 15.64) is followed for classifying the students. Thus 92, 329 and 67 high school students were classified as Low, Moderate and High group on the basis of the scores on their Achievement in Science Subject.

Table – 2
Wilk's Lambda and F Statistics for Test of Equality

Variable Code	Independent Variable	Wilks' Lambda	F	P
X_1	Gender	.971	7.271	.001**
X_2	Fathers' Educational Qualification	.969	7.873	.000**
X_3	Mothers' Educational Qualification	.984	3.916	.021*
X_4	Income of the Family	.994	1.341	.262
X_5	Family Size	.999	.263	.769
X_6	Locality of the School	.976	5.845	.003**
X_7	Type of the School	.997	.714	.490
X_8	Management of the School	.986	3.480	.032*
X_9	Overall Science Interest	.997	.739	.478
X_{10}	Overall Attitude towards Science Practical	1.000	.084	.920
X_{11}	Overall Availability of Physical Facilities	.994	1.408	.246
Y	Overall Achievement in Science	.253	714.561	.000**

Note: *-indicates that 5% level significance, **-indicates that 1% level Significance.

The table depicts that there is a significant difference among the three groups (Low, Moderate and High Level of Achievement in Science) only for six predictive variables namely Gender, Fathers' Educational Qualification, Mothers' Educational Qualification, Locality of the School, Management of the School and Overall Achievement in Science of High School Students. In other words, these six variables are able to discriminate the students significantly in three groups.

Table – 3
Box's M Test Results

Box's M		99.320
F	Approx.	16.391
	df1	6
	df2	355638.109
	Sig.	.000**

Note: **-indicates that 1% level Significance.

To examine whether there is an equal variance among the group. Box's M test has been worked out. Results are presented in the above table. Results reject to the general assumption and null hypothesis that, "there is no equal variance among groups" and depicts that there is an equal variance between the groups with Box's M value 99.32 and p value 0.000.

Table – 4
Canonical Discriminant Function and Canonical Correlation

Function	Eigen value	% Of Variance	Cumulative %	Canonical Correlation
1	2.952[a]	99.2	99.2	.864

Strength of Relationship between Predictive Variables and Outcome Groups: To measure the strength of relationship between predictive variables and outcome groups, canonical Discriminant functions were used in the analysis; results are presented in the above table. Results depicts that there is a high degree positive canonical correlation (0.864) exists between predictive variables and outcome groups.

Table – 5
Wilks' Lambda and Chi-Square test

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.247	677.115	4	.000**

Note: **-indicates that 1% level Significance.

Statistical Significance and Discrimination Power of the model: the above table depicts that the results of chi-square test with 'Successive Root Removed'. Table shows a Wilk's Lambda (1- canonical correlation^2) value 0.247 which is close to 0.2. Though it ranges from 0-1 but, value close to 0 is considered well which indicates better discriminating power of the model. The Chi-Square test shows the highly significant discrimination among the three groups at 1% level of significance with Chi-Square value = 677.115 and p =0.000.

Table – 6
Classification Results of the Sample

Actual Group	Predicted Group Membership			Total
	Low	Moderate	High	
Low	92 (100)	0 (0)	0 (0)	92
Moderate	40 (12.2)	254 (77.2)	35 (10.6)	329
High	0 (0)	0 (0)	67 (100)	67
Percentage of "Grouped cases correctly classified = 84.6% of original cases correctly classified = 92+254+67 = 413"				

Prediction Power of the Model: the results of classification matrix are presented in the above table. The table depicts that the Discriminant function obtained is able to classify 84.6% of the 488 students correctly. More precisely it is to say that out of 92

cases predicted in group 1, 92 were found to be in group 1, out of 329 cases predicted in group 2, 40 were found to be in group 1 and 35 were found to be in group 3, out of 67 cases predicted in group 3, 67 were found to be in group 3. By this way total 75 (40+35) cases were misclassified in the Discriminant model. The model classifies 84.6% of original grouped cases correctly. In other words, the model gives us the prediction accuracy of 84.6% which is calculated as (total case – misclassified cases)/total cases = (488-75)/488 = 84.6%.

Table – 7
Standardized Canonical Discriminant Function Coefficients

Variable Code	Independent Variables	Function
		1
Y	Overall Achievement in Science	.999
X_{10}	Overall Attitude towards Science Practical	.124
X_9	Overall Science Interest	.099
X_4	Income of the Family	-.061
X_6	Locality of the School	.014
X_8	Management of the School	.028
X_7	Type of the School	-.083
X_{11}	Availability of Physical Facilities	.142
X_1	Gender	.033
X_3	Mother's Educational Qualification	.063
X_2	Father's Educational Qualification	.087
X_5	Family Size	.008

Identification of the Variables Discriminating the Groups: To identify the variables significantly discriminating one group with other, this study includes 12 independent variables such as mentioned the above table. Results depicts that variable overall Achievement in Science is best predictor with the coefficient value 0.999 followed by Availability of Physical Facilities, Overall Attitude towards Science Practical, Overall Science Interest, Fathers' Educational Qualification, Mothers' Educational Qualification, Gender, Management of the School, Locality of the School and Family Size. Two variables were found to have Negative Coefficient such as Income of the Family and Type of the School which shows a Negative Contribution towards the Discriminant Function.

7.0 Fisher's Linear Discriminant Function

With a view to developing a Linear Discriminant Function equation. Fisher's Discriminant Co-Efficient has been calculated for those 2 significant variables and they are given in the table.

Table – 8
Fisher's Linear Discriminant Function Co-Efficient

Step No	Variable Code	Variables	Low Group 1	Moderate Group 2	High Group 3
1	X6	Locality of the School	1.859	2.039	1.446
2	Y	Overall Achievement in Science	.646	1.035	1.409
(Constant)			-15.790	-36.778	-64.462

Using the results, three linear Discriminant functions (equations) were drawn as given below:

Y_L = 1.859 X6 + 0.646 Y – 15.790
……. Low Group

Y_M = 2.039 X6 + 1.035 Y – 36.778
…….. Moderate Group

Y_H = 1.446 X6 + 1.409 Y – 64.462
…….. High Group

Table - 9
Functions at Group Centroids

Level of the Achievement in Science	Function
	1
Low	-2.896
Moderate	.176
High	3.115

The above table depicts that the new means of the transformed group centroids. The mean of first group centroid (Low) is -2.896, mean of second group centroid (Moderate) is 0.176 and mean of third group centroid (High) is 3.115 which give the decision rule for classifying new case (student). If the Discriminant score of the new student is Positive, we classify him/her as Moderate Level or High Level and vice versa.

8.0 Findings of the Study

- There is a significant difference among the three groups (Low, Moderate and High Level of Achievement in Science) only for six predictive variables namely Gender, Fathers' Educational Qualification, Mothers' Educational Qualification, Locality of the School, Management of the School and Overall Achievement in Science of High School Students. In other words, these six variables are able to discriminate the students significantly in three groups.
- There is an equal variance between the groups.
- There is a high degree positive canonical correlation (0.864) exists between predictive variables and outcome groups.
- The Discriminant function obtained is able to classify 84.6% of the 488 students correctly.
- Overall Achievement in Science is best predictor with the coefficient value 0.999 followed by Availability of Physical Facilities, Overall Attitude towards Science Practical, Overall Science Interest, Fathers' Educational Qualification, Mothers' Educational Qualification, Gender, Management of the School, Locality of the School and Family Size.
- Two variables were found to have negative coefficient such as Income of the Family and Type of the School which shows a Negative Contribution towards the Discriminant Function.

9.0 Recommendations of the Study

- The innovative approach of teacher towards science learning should inculcate interest in science learning among the high school students. Science Interest can be created among the students by conducting science exhibition, field trip, science club, Science Projects.
- Teachers can teach science with experimental and demonstrative method. Self-Learning of high school students such as dissecting of flower, parts of a plant, maintaining an Herbarium with assistance of the teacher. Refined curriculum assisted with technology will improve the attitude of science practical of high school students. The in-service training of teachers, updating of day-to-day science knowledge among teachers, will help them to disseminate their knowledge of facts and frictions of science.
- A lot of improvement has to the carried out to improve the infrastructure and laboratories of high schools. When a student starts to use the materials and equipment's in the lab with the assistance of the teachers he gradually increases in Attitude, Interest and Achievement in Science.

10.0 Conclusion

In this study the investigator analyzed the Factors Influencing Achievement in Science of High School Students Using Discriminant Function Analysis. From the study the investigator concluded that the overall Achievement in Science is best predictor followed by Availability of Physical Facilities, Overall Attitude towards Science Practical, Overall Science Interest, Fathers' Educational Qualification, Mothers' Educational Qualification, Gender, Management of the School, Locality of the School and Family Size. Two variables were found to have Negative Coefficient such as Income of the Family and Type of the School which shows a Negative Contribution towards the Discriminant Function.

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